Spawning Distribution of Fall Chinook Salmon in the Snake River

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SPAWNING DISTRIBUTION OF FALL CHINOOK SALMON IN THE SNAKE RIVER

ANNUAL REPORT 1999

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CHAPTER ONE

Progress toward determining the spawning distribution of supplemented fall chinook salmon in the Snake River basin upriver of Lower Granite Dam in 1999

by

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Abstract

In 1999, we collected data on the spawning distribution of hatchery fall chinook salmon that were released upriver of Lower Granite Dam. Yearling fish were released at three locations that were phased in over a three-year period. Multiple release sites were used with the intent to distribute spawning throughout the existing habitat, and our project was designed to determine if this actually occurred. We first trapped returning fish at Lower Granite Dam, identified their origin (all fish were externally marked), and used radio-tags to follow the fish to where they spawned. The initial plan was to tag and track about 50 returning adult females from each release site over a five-year period, 1998–2002. In the course of our work, however, we found that we could not track about 30% of the fish that we tagged. As a result, we increased the tagging target to 90 fish per release site. Mostly female fish were targeted so that we could determine spawning locations by observing redds, although some male fish (adults and one-ocean males) were also targeted to obtain information on the movements of both sexes and all age groups. In addition, returns from subyearling hatchery fish released (and PIT-tagged natural fish) upriver of Lower Granite Dam were targeted for radio-tagging to augment the project. In 1999, a total of 73 fall chinook salmon were radio-tagged, and tagging and tracking proceeded as planned. The data collected during the 1999 field season is being processed and a preliminary analysis will be included in upcoming reports. A preliminary analysis of the data collected in 1998 showed that roughly 80% of the yearling fish released at Pittsburg Landing spawned in the upper half of the Hells Canyon Reach. This suggests the release strategy may produce the desired spawning distribution for this release site. The same cannot yet be said for the other sites. Preliminary data from the Captain John site shows adult fish from subyearling releases entered the Grande Ronde River, whereas returns from yearling and subyearling releases at the Pittsburg Landing site did not.

Introduction

In 1996, yearling fall chinook salmon (*Oncorhynchus tshawytscha*) from Lyons Ferry Hatchery were released in the Snake River upriver of Lower Granite Dam. This release marked the beginning of a program to increase natural production in the Snake River and tributaries using supplementation. The supplementation program called for hatchery fish to be released at three locations that were phased in over a three-year period (1996–1998). The first release location was in the Snake River at Pittsburg Landing, about 109 miles upriver of Lower Granite Dam. The second release location was in the Clearwater River near Big Canyon Creek, roughly 67 miles upriver of the dam. The final release site was in the Snake River near Captain John Rapids, about 57 miles upriver of Lower Granite Dam. Multiple release locations were used with the intent of distributing spawning throughout the existing spawning habitat.

The fall chinook salmon supplementation program was designed to include a thorough evaluation (WDFW et al. 1996). Our part in the evaluation was to determine where the supplemented fish spawned, and whether or not the use of multiple release sites resulted in a widespread spawning distribution. To augment the information collected in our study, we also planned to radio-tag adult fall chinook salmon that were released as subyearlings, or produced naturally, upriver of Lower Granite Dam.

Our project began in 1997 and was scheduled for completion in 2002. In 1999, we collected the data on fish that were released at Pittsburg Landing in 1996 and 1997, Big Canyon Creek in 1997, and Captain John Rapids in 1998. In this report we present summary information on the work conducted from 1997 to 1999, and preliminary findings based on the data collected up to 1998 (Garcia et al. 1999).

Description of Project Area

The study area included the Snake River from Ice Harbor Dam to Hells Canyon Dam, portions of the Grande Ronde, Imnaha, and Salmon rivers, all of the Clearwater River, and some tributaries of the Salmon and Clearwater rivers (Figure 1). River locations were referred using river miles (RM). Our work was routinely conducted along 178 miles of the Snake River from Little Goose to Hells Canyon dams, 41 miles of the Clearwater River from the mouth to Dworshak Fish Hatchery, 53 miles of the Grande Ronde River from the mouth to Wildcat Creek, and 4 miles of the Imnaha River from the mouth to Cow Creek Bridge. Radio-tracking was also conducted in other parts of the study area, though less frequently.

Methods and Materials

There were four main components in our study design: (1) radio-tag target fish at the Lower Granite Dam adult fish trap; (2) track the tagged fish throughout the Snake River and tributaries; (3) conduct redd searches (covered in Chapter 2); and (4) data analysis.

Radio Tagging

All yearling fall chinook salmon released upriver of Lower Granite Dam were injected with a colored elastomer tag that, in combination with placement (right or left eye), could be used to determine where each fish was released. Fish released at Pittsburg Landing were injected with a blue- or green-colored elastomer near their right eye. Fish used for this study and released at Big Canyon Creek had a green-colored elastomer near their left eye, and fish released at Captain John Rapids had a blue-colored elastomer near the left eye. The origin of hatchery fish that were released as subyearlings was determined using PIT-tags that were implanted prior to release. PIT-tags were also used to identify known wild fish. These wild fish were initially captured in the Snake and Clearwater rivers when they were juveniles, and PIT-tagged for research purposes (William P. Connor, USFWS, personal communication).

We need to track at least 50 fish from each release site to where they spawn in order to make valid comparisons between release groups. To meet this target in the most effective manner mostly female fish were tagged so that we could determine spawning location using redd searches (Scott and Crossman 1973, Schroder 1981). Male fish (adults and one-ocean males) from each release group were also tagged to obtain information on the movements of all age groups and both sexes, although the actual spawning location of these fish could not be determined using redd searches, and the number that were tagged was mainly dependent on the availability of radio tags.

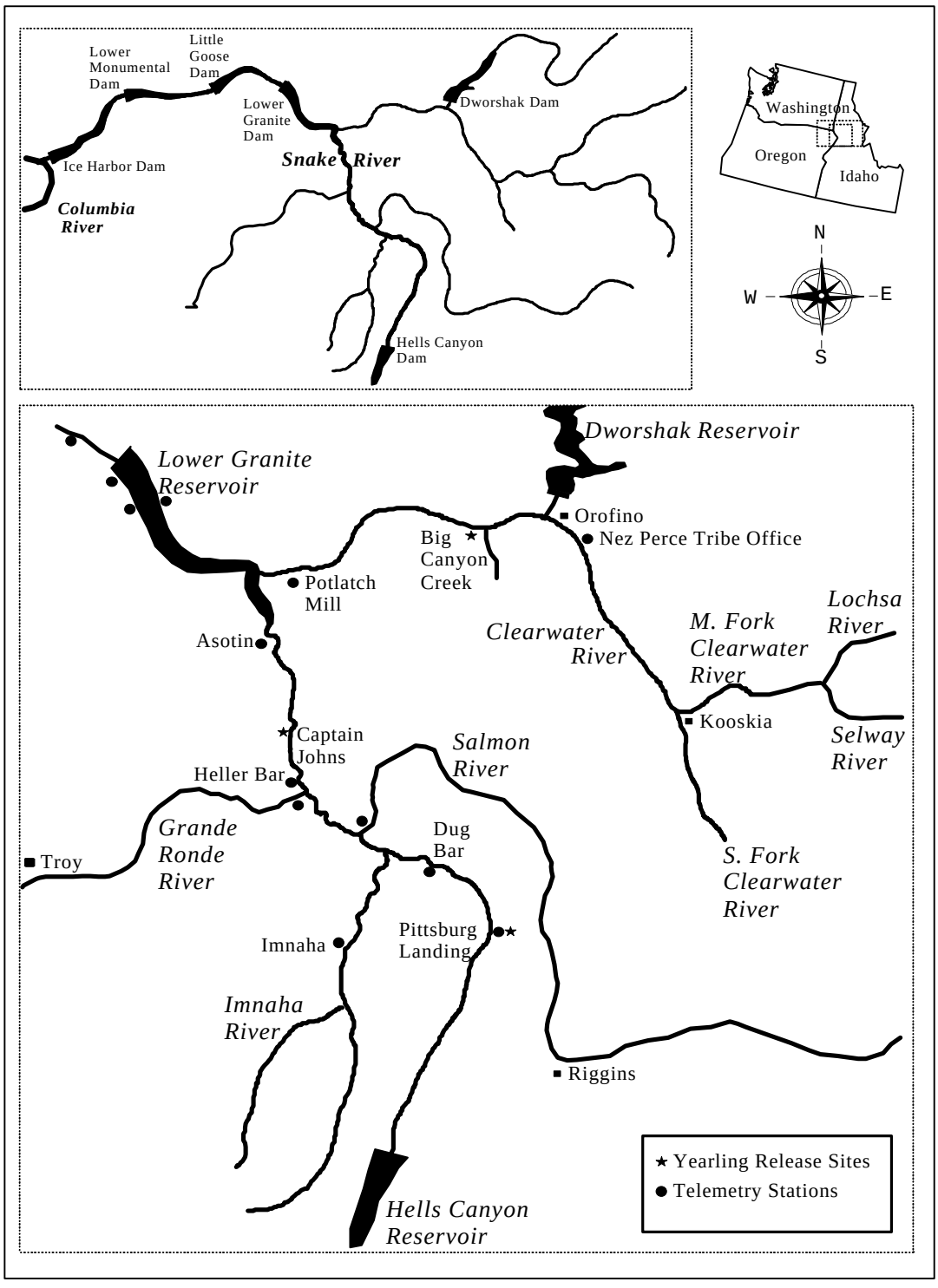

Figure 1. Map of the Snake River drainage in Oregon, Washington, and parts of Idaho.

Fish were captured at the Lower Granite Dam fish trap and anesthetized. Radio tags were coated with glycerine and inserted into the esophagus of study fish. Two sizes of radio tags were used depending on the length of the fish; 16-g tags (Lotek[1] MCFT-3) were used for fish less than 60 cm, and 29-g tags (Lotek MCFT-7A) for fish 60-cm and larger. All tags for the project were obtained free-of-charge from the University of Idaho.

Tracking

Tracking was conducted by the U.S. Fish and Wildlife Service (USFWS), Nez Perce Tribe (NPT), University of Idaho, and WDFW. Fish were tracked using fixed receivers and mobile tracking methods.

Fixed-telemetry receivers were maintained and operated by the USFWS and the University of Idaho. In the Snake River, fixed receivers were positioned at, and downriver of, Lower Granite Dam, and at Heller Bar (RM 168), Dug Bar (RM 197), and Pittsburg Landing (RM 215). In the Clearwater River, fixed telemetry stations were located near Potlatch Mill (RM 5), and near Orofino at the Nez Perce Tribe Fisheries Office (RM 47). Telemetry stations were also positioned within the lower mile of the Grande Ronde and Salmon rivers. Tracking data were downloaded from these receivers periodically. Receivers indicated when an individual radio tag (fish) arrived and departed, and in some cases, which direction (upriver or downriver) the fish was traveling.

Mobile tracking was conducted by the USFWS, NPT, and WDFW. Portions of the Snake River reservoirs were surveyed weekly using fixed-wing aircraft. The roaded sections of the Snake, Clearwater, and lower Grande Ronde rivers were surveyed weekly via automobile. Portions of the un-roaded section of the Snake River were surveyed weekly by boat (in the course of downloading fixed receivers) and helicopter (while conducting redd searches).

Redd searches

Redd searches were used to determine when and where radio-tagged female fish constructed a redd, and as part of an ongoing monitoring program in the Snake River basin. Details of these searches can be found in Chapter 2 of this report.

Data analysis

Data analysis was divided into three components: (1) determine the spawning location of individual fish; (2) group spawning locations by release location/origin; and (3) determine if spawning distribution varies between groups.

[1] The use of trade names does not imply endorsement by the U. S. Government.

Results and Discussion

Thus far, 159 fall chinook salmon have been radio-tagged as part of this project (Table 1). This amounts to about 40% of our target of 375 fish. We are finished tagging one-ocean males, and next year plan to tag 20 to 30 adult fish from each release group and as many PIT-tagged subyearling and natural fish as we can get tags for (estimate 30 total).

Table 1. Tagging schedule by year and target group for Snake River fall chinook salmon.

Year	Pittsburg Landing (PLD)	Big Canyon Creek (BCC)	Captain John Rapids (CJR)	Subyearling and natural fish	Totals	Comments
1997	16			6	22	PLD fish were one-ocean males
1998	30	15		19	64	BCC fish were one-ocean males
1999	21	28	14	10	73	CJR fish were one-ocean males
2000	23	30	25	30	108	Proposed
2001		17	30	20	67	Proposed
2002			21	20	41	Proposed
Totals	90	90	90	105	375	

1999 Data Collection Summary

Tagging. — In 1999, we radio-tagged 73 fish (Appendix 1), and of these, 21 were adults returning from releases of yearlings at Pittsburg Landing, 28 were returning adults from Big Canyon Creek, and 14 were one-ocean males returning from the first release at Captain John Rapids. In addition, three natural adult fish, and seven adult fish from subyearling releases were tagged (two from releases at Big Canyon Creek, and five from releases at Pittsburg landing).

In-season events. — In past years the NMFS crew at Lower Granite Dam conducted the trapping and tagging without our assistance on station. In 1999, however, they requested help and we supplied a person for a few weeks at the peak of the run. We plan to do this again next year. In addition, overlap in coho and fall chinook salmon tagging operations required extra efforts in coordination and planning to avoid duplication of effort (this went reasonably well, although two fish were tagged with duplicate tags in the course of the season). Lastly, we were advised that there was a chance we may not receive all the tags we need for the upcoming year.

Tracking. — Tracking progressed as planned in 1999. We increased our tracking intensity in the Clearwater River and were able to maintain routine tracking in other portions of the study area without encountering any significant problems. In addition, we changed our maintenance protocol at the remote telemetry stations, and by doing so, avoided the power-failures like we experienced in 1998. At this point, the tracking data collected in 1999 is still being processed.

Preliminary Findings from 1997-1998

We tagged a total of 86 fish in 1997 and 1998, and of these, 25 (30%) were not tracked to where they spawned. Five of the tags were recovered during the spawning season (one pulled at Hells Canyon Dam fish trap, two returned by anglers, and two regurgitated in the Lower Granite Dam fish ladder). We believe most of the remaining 20 tags either failed prior to the end of the spawning season, dropped below the study area, or were regurgitated in areas of Lower Granite Reservoir that were too deep to allow detection. To compensate for the number of fish we could not track, and ensure we would be able to achieve our objectives, we plan to increase the number of fish we initially set out to tag per release site from 50 to 90.

In 1998, we tracked 14 adult Pittsburg Landing fish to redds, 11 (80%) of which spawned in the upper half of the Snake River study area. The Pittsburg landing release site is located within the upper third, and the Captain John Rapids site within the lower third, of the study area. The distribution of these radio-tagged fish provides the first empirical evidence that the current strategy of releasing yearlings at three sites may result in the desired, widespread, spawning distribution. All of the adult female Pittsburg Landing fish were tracked to spawning sites in the Snake River.

We tracked 20 one-ocean males (ten from the Big Canyon Creek and ten from Pittsburg Landing). Of these, three (15%) strayed from the river where they were initially released. The most extreme case was a jack from Big Canyon Creek release group that made six different river entries (two into the Snake River, three into the Clearwater River, and one into the Imnaha River).

A total of seven wild PIT-tagged fish were tagged from 1997 to 1998 (five from the Snake River, one from the Grande Ronde River, and one from the Clearwater River). Of these, four were tracked to their spawning location, each within their parent river.

From 1997 to 1998, we tagged 18 hatchery fish that were released as subyearlings (eight from releases of non-acclimated PIT-tagged fish near Captain John Rapids, and ten at Pittsburg Landing). We were able to track five of the fish from releases near Captain John Rapids, three of which (60%) spawned in the lower half of the Snake River study area, and two of which (40%) moved between the Snake and Grande Ronde rivers. All of the fish from subyearling releases at Pittsburg Landing spawned in the upper half of the Snake River study area.

Summary and Conclusions

The project is proceeding as planned, although we need to increase the number of fish we tag from 50 to 90 per release group to compensate for fish that were not detected after tagging. In addition, we may not be able to obtain all the used radio tags we need from the University of Idaho and are looking at other possible sources. Coordination with all cooperating groups is going smoothly. A summary of budget expenditures for telemetry work is included in Appendix 3 of this report.

The preliminary analysis of the data collected in 1998 shows that most (80%) of the adult fish returning from releases at Pittsburg Landing, spawned in the upper half of the Hells Canyon Reach. This indicates the current release strategy may work for the Pittsburg Landing release site. Data on the spawning distribution of adult returns from the Big Canyon Creek release site was first collected in 1999, and a preliminary analysis of their spawning distribution will be included in the 2000 annual report. Data on adult returns from the Captain John Rapids release site will be collected starting this year and preliminary findings will be included in the 2001 annual report. Data collected from subyearlings released at Captains John Rapids showed some of the fish strayed into the Grande Ronde River, whereas fish from the other release sites did not.

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CHAPTER TWO

Fall chinook salmon spawning ground surveys in the Snake River basin upriver of Lower Granite Dam, 1999

by

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Abstract

In 1999, aerial searches for fall chinook salmon redds were conducted upriver of Lower Granite Dam in portions of the Snake, Grande Ronde, Imnaha, and Salmon rivers, all of the Clearwater River, and some tributaries of the Clearwater River. In addition, underwater searches were conducted in the Snake River using submersible cameras. A total of 579 redds were counted, and of these, 373 were observed in the Snake River (273 during aerial searches, and 100 using submersible cameras), 181 in the Clearwater River, one in the North Fork Clearwater River, two in the South Fork Clearwater River, 13 in the Grande Ronde River, and nine in the Imnaha River. The total redd count in 1999 was the highest recorded in recent years (303 were counted in 1998, and 189 in 1997), and corresponded with an increase in the number of adult fall chinook salmon counted at Lower Granite Dam (1,917 in 1999 vs. 962 in 1998). Techniques to guide underwater searches using GPS technology were tested by Idaho Power Company (IPC) biologists, and may be employed by both USFWS and IPC crews next year. Although two Nez Perce Tribe biologists and a pilot were injured when the helicopter they were using for redd searches crashed on 2-November-1999, search effort remained high throughout the spawning season.

Introduction

Redd searches were conducted between Lower Granite and Hells Canyon dams in 1999 as part of an ongoing effort to annually monitor fall chinook salmon spawning in the Snake River and tributaries. The first reports of redds observed in this area were from aerial searches of the Snake River conducted intermittently between 1959 and 1978 (Irving and Bjornn 1981, Witty 1988; Groves and Chandler 1996)(Appendix 2). In 1986, the Washington Department of Fish and Wildlife (WDFW) began an annual redd-search program that included aerial searches of the Grande Ronde River the first year (Seidel and Bugert 1987), and the Imnaha River in subsequent years (Seidel et al. 1988; Bugert et al. 1989-1991; Mendel et al. 1992). The U. S. Fish and Wildlife Service (USFWS) and Idaho Power Company (IPC) began contributing to this monitoring effort in 1991 by increasing the number of aerial searches conducted each year, and by adding underwater searches in areas of the Snake River that were too deep to be searched from the air (Connor et al. 1993; Garcia et al. 1994a, 1994b, 1996, 1997, 1999; Groves 1993; Groves and Chandler 1996). The Nez Perce Tribe (NPT) also contributed to the effort by adding aerial searches within the Clearwater River basin beginning in 1988 (Arnsberg et. al 1992), and the Salmon River basin beginning in 1992.

The objective of this report is to consolidate the findings from annual redd searches into a single document containing detailed information from the most recent spawning season, and summary information from previous years. The work conducted in 1999 was funded by the Bonneville Power Administration (Projects: 9403400, 9801003), Idaho Power Company, U.S. Bureau of Land Management – Cottonwood Resource Area, and U.S. Forest Service – Wallowa Whitman National Forest.

Description of Project Area

The study area included the free-flowing Snake River between Lower Granite and Hells Canyon dams, and portions of the major tributaries that enter therein (Figure 1). We refer to redd locations using river miles (RM), and nearby landmarks. In 1999, the following eight river

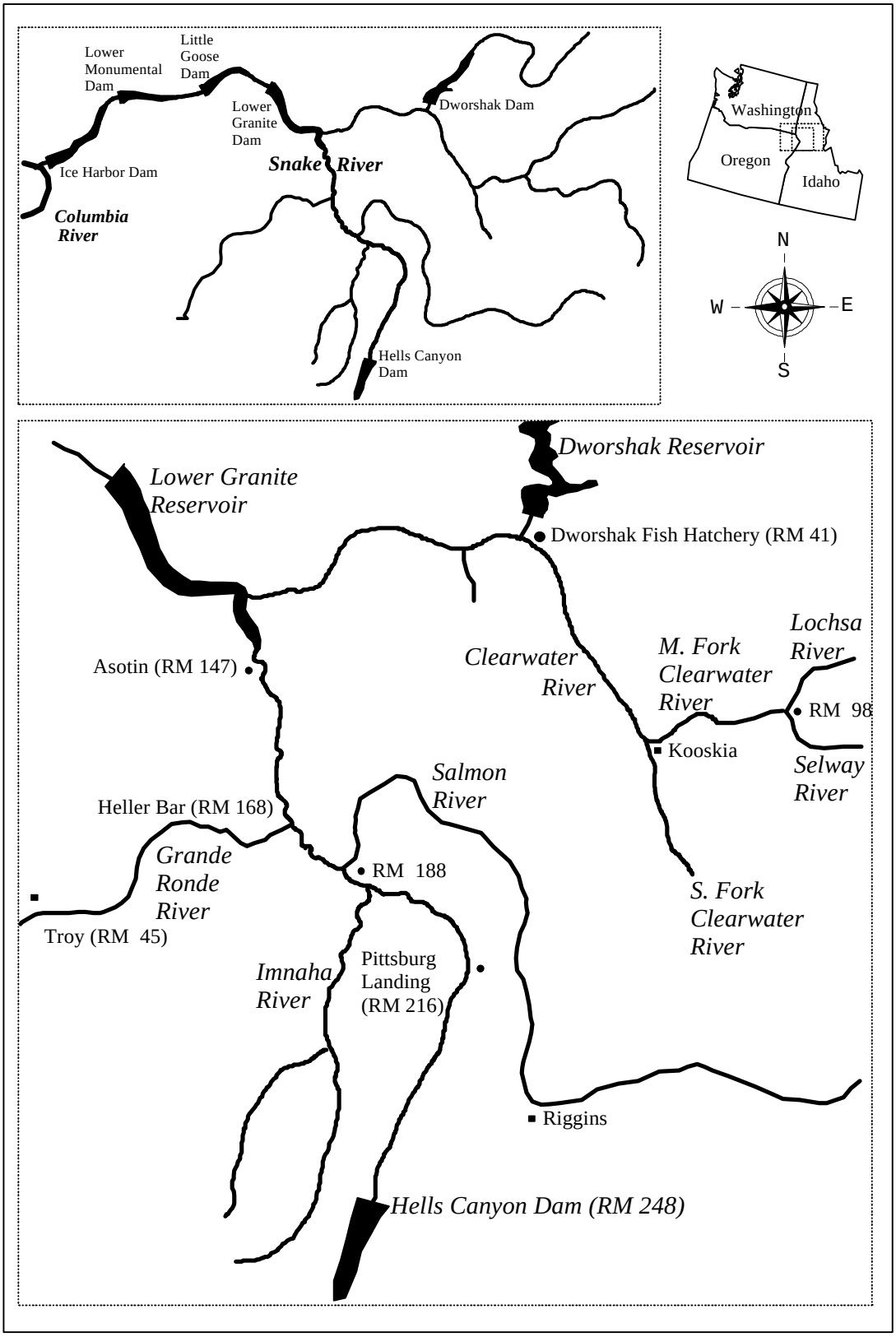

Figure 1. Map of the Snake River drainage in Oregon, Washington, and parts of Idaho.

sections were regularly searched: (1) the Snake River from the head of Lower Granite Reservoir (RM 147) to Hells Canyon Dam (RM 248); (2) the Clearwater River, to its confluence with the Selway River (RM 98); (3) the Selway River to Meadow Creek (RM 19); (4) the North Fork Clearwater River to Dworshak Dam (RM 2); (5) the South Fork Clearwater River to Butcher Creek (RM 12); (6) the Grande Ronde River to Wildcat Creek (RM 53); (7) the Imnaha River to near Freezeout Saddle (RM 35); and (8) the Salmon River to about French Creek (RM 105). The Potlatch River was also searched in 1999 by NPT biologists with the intent of finding redds constructed by coho salmon.

Methods and Materials

Redd searches were conducted from a helicopter flown at an altitude of about 700-ft. or less. Observations were made by the pilot and one or two observers. Only the number of new redds observed on each search were included in this report. From 1991 to 1999, searches in the Snake, Clearwater, Grande Ronde, and Imnaha rivers were scheduled to be conducted at approximately 7-d intervals starting around mid-October and ending around mid-December. In previous years, and in the other rivers, searches were typically conducted less frequently. In most years, some of the scheduled searches were canceled or shortened due to poor visibility or inclement weather. Redds observed in the Snake River that could not clearly be distinguished from the air were examined from the ground beginning in 1991. This practice was also performed in the other rivers, though less consistently.

In addition to the helicopter searches, redd searches in the Snake River were conducted using underwater search methods to locate redds in areas too deep to be effectively searched from the air. In 1991 and 1992 the USFWS conducted underwater searches using methods developed by Swan (1989) that involved direct observation of the river bottom by scuba divers (Connor et al. 1993; Garcia et al. 1994a). From 1993-1999, the USFWS and IPC conducted underwater searches using a video system consisting of a DC-powered video recorder, submersible camera, 110° lens, 65-ft camera cable, and at least one monitor. The submersible camera was either enclosed in an aluminum sheath mounted on a 90-lb lead weight, or attached to an aluminum frame mounted between two 30-lb lead weights, and could be adjusted 45° to 90° down from horizontal (Groves and Garcia, 1998). The camera was suspended from a boat using a wire rope passed through a roller on the bow and attached to a sounding-reel/depth-indicator mounted in the boat cabin.

Searches using submersible cameras were conducted by passing the camera over the river bottom in a zigzag pattern, or by moving upriver along parallel paths. In each case, the distance between passes was about 30-ft. From 1993 to 1998, only the zig-zag search pattern was used, and the distance between passes was judged either by estimating distance using natural land features, or by placing a rope constructed of different-colored 30-ft sections along the shoreline. In 1999, both the parallel-path and zig-zag search patterns were used. Parallel paths were maintained using a GPS receiver and a computer display that showed real-time position relative to prescribed paths drawn in over a map of each study site. During all searches, the distance between the camera and river bottom, and the angle of the camera, was adjusted to maximize the amount of viewable area

without losing our ability to observe details of the bottom substrates. If a redd was observed, the distance between passes in the search pattern was reduced by about half, and in most cases, the entire area was searched at least one more time.

Underwater observations of redds were recorded on video tape beginning in 1993, and, when large groups of redds were found, corresponding survey coordinates were also recorded using electronic surveying equipment positioned on shore, or a GPS receiver positioned on the boat. These coordinates were used to plot the position of redds observed on each search so they could be referenced along with the video tape to determine the total number of redds at each spawning location. In areas where redds overlapped and could not be identified individually, the perimeter of the redd group was surveyed and the overall area divided by the average size of fall chinook salmon redds observed in the Columbia River (183 ft^2)(Chapman et al. 1986). This produced an index count of the total number of redds in the group.

Underwater searches were limited to areas greater than about 10-ft deep with a dominant bottom substrate particle size (Bovee 1982) ranging from 1 to 6-in. diameter (Raleigh et al. 1986). In 1991 and 1992, a few pilot searches were conducted at known spawning sites. Then from 1993 to 1999, we attempted to annually search about 90 deep-water areas that fit the substrate size and the depth criteria (based on Hells Canyon Dam discharged of about 9,000 cfs), although not all the sites were searched each year. Some of the spawning sites that were typically only searched from the air were also searched using submersible video cameras during spawning seasons when Hells Canyon Dam discharge was higher than 9,000 cfs.

Results and Discussion

Snake River.— A total of 373 redds were observed in the Snake River in 1999, the highest number recorded since annual searches began in 1986 (Table 1). Of the 373 redds, 273 were observed during nine aerial searches (Table 2), and 100 were observed using submersible cameras (Table 3) at 14 of 73 deep-water sites searched (Table 4), plus three sites that were normally searched from the air. Redds were observed in 21 areas (14 shallow, and 7 deep) not known to be used by spawning salmon prior to 1999. Overall, the redds counted in the Snake River amounted to 64% of all redds observed upriver of Lower Granite Dam in 1999, compared to 61% in 1998, 31% in 1997, and 55% in 1996.

Aside from a couple of unfortunate events that occurred during the 1999 spawning season, searches of the Snake River went as planned. The number of searches conducted was comparable to that of recent years (Table 5). Aerial search conditions were reported as “good” to “fair” on all but one river section during one search (downstream of the Grande Ronde River on 01-Dec). Poor visibility did not hamper underwater searches as in 1998, mainly because searches downriver of the Grande Ronde were started earlier than usual in 1999 to avoid the usual fall freshets. During all of the searches (both aerial and underwater), river discharge ranged from about 11,000 cfs to 13,200 cfs at Hells Canyon Dam (RM 248), and 17,000 cfs to 19,000 cfs at the Anatone Gauge (RM 167) near the Grande Ronde River. Although most searches went as planned in 1999, the Hiller 12-E helicopter normally used for searches crashed during the 2-Nov search of the Clearwater River basin. The remaining flights were conducted in a Bell Jet Ranger without a

USFWS observer. In addition, the engine in the USFWS boat used to conduct underwater redd searches failed near the end of the season, and the boat had to be towed 30 miles through Hells Canyon at a cost of about $2,000. Fortunately, the IPC search crew was able to search the remaining sites scheduled to be searched by the USFWS crew.

Prior to the 1999 spawning season, IPC and USFWS crews searched for additional deep-water spawning areas downstream of the Salmon River, thus completing a reconnaissance of the Snake River that was started in 1998. A total of 13 new potential deep-water sites were found and searched between 1998 and 1999, and redds were located at one of these sites during the 1999 spawning season. The use of radio-telemetry led us to some of the new sites that were searched, and guided us to known sites that might otherwise not have been given priority.

Clearwater River basin.— A total of 184 redds were observed in the Clearwater River basin in 1999, the highest recorded since annual searches began in 1988 (Table 1). Of the 184 redds observed, 179 were in the Clearwater River downriver from the North Fork (Table 6), two were located in the Clearwater River upriver of the North Fork, one was in the North Fork Clearwater near the base of Dworshak Dam on 23-Nov, and two were in the South Fork Clearwater River (the first at RM 3.7 on 9-Nov, and the second at RM 4.4 on 23-Nov). Redds counted in the Clearwater River basin amounted to 32% of all redds observed upriver of Lower Granite Dam in 1999, 26% in 1998, and 38% in 1997.

Search effort remained high in the Clearwater River basin even though the helicopter crash referred to previously occurred while searching the South Fork Clearwater River. After the crash, searches within the Clearwater River basin were conducted in a Bell Jet Ranger by a new crew consisting of a pilot and one observer with minimal experience conducting redd searches, and one experienced observer. Observation conditions were reported as “good” on all but one of the ten searches conducted in 1999 (observation conditions during the ninth search were reported as“poor”, although the flight was conducted more to search for carcasses than to locate redds). During aerial searches of the Clearwater River, river discharge ranged from 2,700 cfs to 5,850 cfs at the Spaulding Gauge (RM 11). More searches were conducted in the Clearwater River basin in 1999 than in 1998 (Table 5).

In 1999, redds were observed in the Clearwater River upriver from the its confluence with the North Fork Clearwater for the first time since 1992. No redds were observed in the Selway River, and although seven redds were below the weir on the Potlatch River (RM 4.4), they were assumed to be constructed by coho salmon (juvenile coho released in the Potlatch River were expected to return as adults in 1999).

Grande Ronde.— A total of 13 redds were observed during seven searches of the Grande Ronde River in 1999 (Tables 5 and 7). River discharge in the Grande Ronde River near Troy, Oregon (RM 45), ranged from 750 cfs to 930 cfs during the searches, and observation conditions were reported as “good” for all searches. The last two scheduled weekly searches were canceled due to poor observation conditions.

Salmon River.— No redds were observed during three searches of the Salmon River in 1999 (Table 5). River discharge in the Salmon River ranged from 4,400 cfs to 4,500 cfs near White Bird, Idaho (RM 54), and search conditions were reported as "good" for each search. Searches of the Salmon River were conducted by the same pilots and observers that searched the Clearwater River basin.

Imnaha River.— A total of nine redds were observed during nine searches of the Imnaha River in 1999 (Tables 1 and 5). The first six, and the eighth, flights covered from the Imnaha River mouth (RM 0) to the Cow Creek Bridge (RM 4), whereas the seventh and ninth flights covered from the mouth to near Freezeout Saddle (RM 35). No redds were observed upriver of the Cow Creek Bridge in 1999. River miles were not recorded for the redds observed in 1999 due to the absence of a second observer. Searches were conducted on the same dates that the Snake River was searched. No redds were observed on the first, second, fourth, and eighth searches; one redd was observed on the third search, three on the fifth, one on the sixth, and two on the seventh and ninth. During all searches, river discharge ranged from 150 cfs to 255 cfs near the town of Imnaha, Oregon (RM 19), and observation conditions were reported as "good".

Summary and Conclusions

A total of 579 redds were observed upriver of Lower Granite Dam in 1999. This was the largest number of redds counted since annual searches began in 1986. The increase in the number of redds counted corresponded with an increase in the number of adult fall chinook salmon counted in the Lower Granite Dam fish ladder (1,917 in 1999 vs. 962 in 1998)(Deborah Milks, WDFW, personal communication). Most of the redds (64%) were observed in the Snake River, followed by the Clearwater River basin (32%), and the Grand Ronde and Imnaha river (2% each).

We were able to conduct nearly all of the scheduled searches in 1999 even though the two of the NPT biologists that normally conduct redd searches were injured during a helicopter crash, and the engine failed in USFWS vessel that was used to conduct underwater redd searches.

The use of GPS to help guide underwater redd searches was tested by the IPC field crew in 1999. The results were encouraging although the ability to get adequate satellite reception in Hells Canyon hampered search effort. IPC is looking into ways to improve satellite reception, and if that is accomplished, the USFWS crew will likely gear up for using GPS in 2000.

A summary of budget expenditures for telemetry work is included in Appendix 3 of this report.

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Chapter 2 Tables

Table 1. Number of fall chinook salmon redds counted in the Snake River and tributaries between Lower Granite and Hells Canyon dams, 1986-1999. An empty cell indicates no searches were conducted in the corresponding river and year. Some of the data is broken down into method, and river mile (RM) sections.

River (method or RM)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Snake (helicopter)[a]	7	66	64	58	37	41	47	60	53	41	71	49	135	273
Snake (underwater video)[b]						5	0	67	14	30	42	9	50	100
Clearwater (RM 0-41)			21	10	4	4	25	36	30	20	66	58	78	179
Clearwater (RM 41-74)							1	0	0	0	0	0	0	2
M.F. Clearwater (RM 74-98)									0	0	0	0	0	0
N. F. Clearwater							0	0	7	0	2	14	0	1
S. F. Clearwater							0	0	0	0	1	0	0	2
Grande Ronde	0	7	1	0	1	0	5	49	15	18	20	55	24	13
Imnaha		0	1	1	3	4	3	4	0	4	3	3	13	9
Salmon							1	3	1	2	1	1	3	0
Selway									0	0	0	0	0	0
Totals	7	73	87	69	45	54	82	219	120	115	206	189	303	579

[a] The targeted search area was the entire reach from the head of Lower Granite Reservoir to Hells Canyon Dam.

[b] The targeted search areas were discrete sites composed mainly of 1-6 in. bottom substrates in water over 10 ft. deep. The number of sites searched varied.

Table 2. New fall chinook salmon redds counted during aerial searches of the Snake River in 1999. Counts are presented by river mile (RM), landmark (from USGS maps and USACE navigation charts), and date. An empty cell indicates no survey was conducted over the corresponding river mile, and a dash (-) indicates no redd were found on the corresponding date.

		New redds counted by flight date									Site
RM	Landmark	11-Oct	18-Oct	25-Oct	01-Nov	11-Nov	16-Nov	23-Nov	01-Dec	07-Dec	totals
149.1	Three Mile Island	-	-	-	1	-	-	-		-	1
151.5	Ten Mile Creek	-	-	-	1	-	-	-		-	1
152.3	Big Bench Point	-	-	-	7	13	-	-		-	20
161.0	Upper Buffalo Rapids	-	-	1	-	-	-	-		-	1
162.5	Captain John Creek	-	-	-	-	1	-	-		-	1
165.7	Billy Creek Range	-	2	2	-	1	-	-		-	5
172.5	Deer Head Rapids	-	-	1	-	-	-	-	-	-	1
178.9	Upper Cochran Range	-	-	5	-	2	-	-	-	-	7
179.6	Cougar Bar Range No. 4	-	-	-	1	4	5	-	-	-	10
188.2	Landing strip	-	-	-	-	1	-	-	-	-	1
190.8	Eureka Bar	-	-	1	-	1	-	-	-	-	2
191.7	Imnaha River	-	-	-	-	1	-	-	-	-	1
193.7	Divide Creek-to-Zig Zag	-	-	-	-	1	-	-	-	-	1
194.0	Big Canyon Range	-	-	3	4	4	-	-	-	-	11
196.0	Rapid No. 97	-	-	3	1	2	-	-	-	-	6
198.2	Camp 71 site	-	-	-	2	9	-	-	-	-	11
198.8	Robinson Gulch	-	-	2	4	5	-	-	-	-	11
201.1	Christmas Creek	-	-	-	-	-	1	-	-	-	1
205.3	Copper Creek	-	-	-	1	5	-	-	-	-	6
206.4	High Range No.1	-	-	-	2	2	-	-	-	-	4
206.6	High Range No. 2	-	-	-	-	2	-	-	-	-	2
207.7	Rapid No. 117	-	-	-	1	1	-	-	-	-	2
207.8	Lookout Creek Range	-	-	-	1	4	-	-	-	-	5
208.0	Forest Boundary	-	-	5	7	13	-	-	-	-	25
209.1	Cottonwood Rapids	-	-	-	-	-	-	-	-	1	1
209.7	Camp Creek	-	-	1	-	-	-	-	-	-	1

(Continued)

Table 2 . (Continued).

RM	Landmark	New redds counted by flight date									Site totals
		11-Oct	18-Oct	25-Oct	01-Nov	11-Nov	16-Nov	23-Nov	01-Dec	07-Dec	
211.9	McCarty Creek	-	3	1	1	4	-	-	-	-	9
213.5	Rapids No. 127	-	-	-	-	2	-	-	-	-	2
213.7	L. Pleasant Rapid No.128	-	-	-	-	1	-	-	-	-	1
215.4	Middle Pittsburg Range	-	-	-	-	1	1	-	-	-	2
216.1	Klopton Creek (OR side)	-	-	-	-	1	-	-	-	-	1
217.3	Coral Creek Reef	-	-	2	6	11	3	-	2	-	24
218.5	Kirby Range No. 1	-	-	-	-	-	3	-	-	-	3
218.7	Kirby Range No. 2	-	-	2	4	5	1	-	-	-	12
219.0	Mid. Kirby Rapids No. 137	-	-	-	-	2	2	-	-	-	4
219.3	Kirby Range No. 5	-	-	1	4	2	1	-	-	-	8
222.7	Lower Suicide (ID side)	-	-	-	3	3	-	-	-	-	6
222.9	Upper Suicide (OR Side)	-	-	1	4	4	-	-	-	-	9
225.0	Little Bar	-	-	-	-	2	-	-	-	-	2
225.1	Caribou Creek	-	-	-	-	-	3	-	-	-	3
226.7	High Bar back eddy	-	-	-	2	-	-	-	-	-	2
235.1	Bernard Creek	-	-	-	-	2	-	-	-	-	2
235.7	Hat Creek	-	-	3	4	-	4	-	-	-	11
236.0	Saddle Creek	-	-	-	1	1	-	-	-	-	2
237.0	Lower Dry Gulch	-	-	1	5	-	-	-	-	-	6
238.3	Three Creek Rapids #2	-	-	-	1	-	-	-	-	-	1
238.6	Three Creek Rapids #1	-	-	1	2	-	-	1	-	-	4
240.5	Granite Ck-to-Rocky Bar	-	-	3	2	3	-	-	-	-	8
240.7	Rocky Bar Camp	-	-	2	3	2	-	-	-	-	7
244.0	Above Chimney Bar	-	-	-	2	-	-	-	-	-	2
244.6	Brush Creek	-	-	-	-	1	-	-	-	-	1
245.3	Across from Square Beach	-	-	-	1	-	-	-	-	-	1
245.8	Head of Lamont Springs	-	-	-	2	-	-	-	-	-	2
	Totals	0	5	41	80	119	24	1	2	1	273
	River mile start	147	147	147	147	147	147	147	168	147	
	River mile end	247	247	247	247	247	247	247	247	247	

Table 3. Record of fall chinook salmon redds counted in the Snake River using submersible cameras in 1999. Counts are presented by river mile (RM), landmark (from USGS maps and USACE navigation charts), search dates, and depth ranges of redds. Individual redds were identified at all sites in 1999.

RM	Landmark	Number of redds	Search Dates 1	Search Dates 2	Redd Depth Range (feet)
179.6	Cougar Bar	30	09-Nov		10 - 21
181.7	Meat Hole [b]	1	15-Nov	22-Nov	7
183.1	Cook Creek [b]	2	10-Nov		13
198.2	Tiger Rock	6	24-Nov	29-Nov	8 - 14
198.8	Robinson Gulch [b]	4	24-Nov		9 - 28
199.4	Trail Gulch	2	24-Nov		20 - 23
208.0	Forest Boundary	11	18-Nov	30-Nov	8 - 12
208.3	Tower Beach [b]	4	30-Nov	01-Dec	11 - 12
211.9	Mc Carty Creek [ab]	1	10-Dec		N.D.
212.2	Davis Creek	24	17-Nov	30-Nov	15 - 18
212.3	Above Davis [b]	2	17-Nov		10 - 15
216.9	Match line [b]	4	01-Dec		11 - 19
218.6	Kirby Lodge	1	22-Nov		11
219.0	Middle Kirby [ab]	1	22-Nov		N.D.
223.2	Hominy Creek [ab]	3	23-Nov		10 - 11
228.0	Sand Creek [b]	2	23-Nov		18
243.0	River mile flag [b]	2	09-Dec		10 - 11
	Total	100			

[a] Sites normally searched from the air.
[b] Sites redds were not found using submersible cameras in previous years.

Table 4. List of sites searched for fall chinook salmon redds in the Snake River, 1999, by river mile (RM), and date.

RM	Date	RM	Date	RM	Date
147.2	11-Nov	181.7	15-Nov	209.9	01-Dec
148.5	01-Nov	181.9	16-Nov	212.2	17-Nov
149.8	11-Nov	183.1	10-Nov	212.3	17-Nov
150.5	01-Nov	184.1	10-Dec	213.3	16-Nov
151.5	17-Nov	184.7	16-Nov	215.3	01-Dec
153.2	02-Nov	188.2	07-Dec	216.9	01-Dec
154.3	03-Nov	188.6	07-Dec	217.8	23-Nov
155.6	02-Nov	193.5	19-Nov	218.2	23-Nov
158.0	03-Nov	193.5	03-Dec	218.5	22-Nov
161.0	04-Nov	193.7	19-Nov	218.6	22-Nov
162.4	04-Nov	193.8	19-Nov	221.0	30-Nov
163.7	04-Nov	194.5	08-Dec	222.3	30-Nov
164.4	08-Nov	198.2	24-Nov	222.8	22-Nov
164.4	06-Dec	198.8	24-Nov	223.7	23-Nov
164.7	16-Nov	199.4	24-Nov	225.1	23-Nov
165.7	09-Nov	202.2	10-Dec	226.8	23-Nov
166.2	08-Nov	202.8	16-Nov	227.9	23-Nov
166.6	09-Nov	203.1	16-Nov	228.0	23-Nov
171.4	22-Nov	203.9	16-Nov	228.6	23-Nov
171.9	11-Nov	204.9	16-Nov	242.2	09-Dec
172.8	11-Nov	206.6	03-Dec	243.0	09-Dec
177.6	15-Nov	208.0	18-Nov	243.3	09-Dec
179.6	09-Nov	208.1	18-Nov	245.8	09-Dec
181.1	08-Dec	208.3	30-Nov		
181.6	08-Dec	209.3	01-Dec		

Table 5. Number of redd searches conducted in the Snake River and tributaries between Lower Granite and Hells Canyon dams, 1986-1999. Data for underwater searches indicates the number of discrete patches of gravels searched, whereas all other data indicates the number of helicopter flights over portions of the corresponding river. River miles (RM) are shown for continuous sections of the Clearwater River.

	Year													
River (search method or RM)	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Snake (helicopter)	1	2	2	2	3	9	8	8	8	7	7	8	8	9
Snake (underwater video)						1	3	50	73	42	32	63	59	73
Clearwater (RM 0-41)			1	2	2	2	2	5	5	3	4	9	5	10
Clearwater (RM 41-74)									5	2	1	7	5	8
M.F. Clearwater (RM 74-98)									1	2	2	2	5	3
N.F. Clearwater							2	4	5	3	5	9	5	7
S.F. Clearwater							2	4	4	1	3	7	5	8
Grande Ronde	1	3	2	1	1	3	6	8	7	3	4	8	6	7
Imnaha		1	2	2	1	9	6	8	8	6	5	7	6	9
Salmon							2	3	3	1	4	3	3	3
Selway									1	2	2	2	5	3

Table 6. New fall chinook salmon redds counted in 1999 during aerial surveys of the Mainstem (RM 0-74) and Middle Fork (RM 74-98) Clearwater rivers. Counts are presented by river mile (RM), landmark, and date.

		New redds counted by flight date										Site
RM	Landmark	05-Oct	13-Oct	19-Oct	26-Oct	02-Nov	09-Nov	16-Nov	23-Nov	30-Nov	07-Dec	totals
8.0	Below Historic Stop	-	-	-	-	-	-	1	-	-	-	1
13.9	Isl. below Potlatch Creek	-	-	-	-	1	-	-	1	-	-	2
17.3	Isl. above Gibbs Eddy	-	-	1	-	-	-	-	-	-	-	1
18.0	Lower Myrtle	1	-	-	-	1	5	5	3	-	-	15
18.9	Myrtle under power line	-	-	-	-	-	-	-	1	-	-	1
19.1	Lower Cottonwood	-	-	-	1	-	1	1	-	-	-	3
19.5	Mid-Cottonwood Is	-	1	-	-	-	3	1	-	-	-	5
21.8	Lower Fir Island	1	-	-	-	-	-	-	-	-	-	1
22.0	Fir Island (Cherry Lane)	4	11	3	10	12	7	7	8	-	-	62
28.3	Below Lenore Bridge	6	7	4	1	4	3	1	-	-	-	26
32.5	Below Tomahawk	-	-	-	5	8	2	-	8	-	-	23
34.0	Leaning Pine Hole	-	-	-	1	-	4	3	1	-	-	9
35.4	Above Old Peck Bridge	-	-	1	-	1	-	-	-	-	-	2
35.7	Above Old Peck Bridge	-	1	2	-	-	-	-	-	-	-	3
36.2	Above Old Peck Bridge	-	-	-	-	2	-	-	1	-	-	3
39.6	Above Pink House	-	-	-	-	-	-	1	-	-	-	1
40.3	Ahsahka Islands	-	-	2	4	6	4	4	1	-	-	21
53.4	Woodland Grade Turnoff	-	-	-	-	-	-	2	-	-	-	2
	Totals	12	20	13	22	35	29	26	24	0	0	181
	River mile start	0	0	0	0	0	0	0	0	0	0	
	River mile end	98	74	98	74	74	74	98	74	41	41	

Table 7. New fall chinook salmon redds counted during aerial searches of the Grande Ronde River, 1999. Counts are presented by river mile (RM), landmark, and date.

		New redds counted by flight date							Site
RM	Landmark	11-Oct	18-Oct	25-Oct	01-Nov	11-Nov	16-Nov	23-Nov	totals
4.5	Near Joseph Creek	-	-	-	-	-	1		1
27.9	Below Cottonwood Ck.	5	-	1	-	-	-	-	6
43.2	Troy Grade	-	1	1	-	-	-	-	2
47.5	Two Creeks	1	-	2	-	-	1	-	4
	Totals	6	1	4	0	0	2	0	13
	River mile start	0	0	0	0	53	0	0	
	River mile end	53	53	53	53	0	53	53	

Appendix 1

Fall chinook salmon tagging records by date for 1999 at Lower Granite Dam.

Seq.	Radio Tag		Elastomer		Tag	FL			CWT	Initial Release or	Age at	Release	
No.	Chan	Code	Tag	Pit Tag Code	Date	(cm)	Sex	Clips	Nose	Tagging Location	Release	Year	Notes
1	19	116	Left Green		02-Sep-99	74	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
2	19	106	Right Green		02-Sep-99	77	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	Open sore on fish
3	19	84	Right Blue		02-Sep-99	85	F	Adipose	Yes	Pittsburg Landing	Yearling	1996	
4	19	108	Right Green		02-Sep-99	78	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	Open sore on fish
5	19	103	Right Green		02-Sep-99	76	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
6	19	118	Right Green		03-Sep-99	79	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
7	19	170	Right Green		04-Sep-99	72	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
8	13	37	Left Blue		04-Sep-99	57	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
9	19	48	Right Green		04-Sep-99	75	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
10	19	37	Right Green		04-Sep-99	68	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
11	19	59	Right Green		04-Sep-99	75	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	Scrape behind head
12	19	92		7F7D510948	05-Sep-99	80	F	None	No	Snake River RM 222	Natural	1995	Open sore on fish and a slightly torn chin
13	19	28		1F401C0E77	06-Sep-99	71	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
14	19	41	Right Green		06-Sep-99	76	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
15	19	169	Right Green		06-Sep-99	78	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
16	19	22	Left Green		06-Sep-99	78	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Tag recovered on Clw at rk 46.5 (RM 28.7) on 11/09/99
17	19	85	Right Green		10-Sep-99	79	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
18	19	24	Right Green		10-Sep-99	71	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	Open sore on fish
19	13	63	Left Blue		11-Sep-99	55	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
20	19	23	Right Blue		11-Sep-99	92	F	Adipose	Yes	Pittsburg Landing	Yearling	1996	Open sore on fish
21	19	111	Left Green		11-Sep-99	79	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish
22	13	9	Left Green		11-Sep-99	72	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Tag found on Clw (RM 22) 11/16; Dup tag with Coho.
23	19	72	Left Green		11-Sep-99	66	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
24	19	142	Right Green		11-Sep-99	79	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	Open sore on fish
25	13	28	Left Blue		12-Sep-99	55	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
26	13	24	Left Blue		12-Sep-99	53	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
27	13	44	Left Blue		12-Sep-99	52	M	Adipose	Yes	Captain John Rapids	Yearling	1998	Tag recovered SNR RM 205.7 on 11/17/99
28	13	170	Right Green		13-Sep-99	67	M	Adipose	Yes	Pittsburg Landing	Yearling	1997	
29	19	121		415760640E	13-Sep-99	73	F	None	No	Big Canyon Creek	Subyearling	1996	
30	19	27	Left Green		13-Sep-99	75	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish; Tag found near LWG on 01/27/00
31	19	25	Right Green	2232266E7C	13-Sep-99	78	F	None	No	Pittsburg Landing	Subyearling	1996	Open sore on fish (TAG CONFLICT)
32	19	80		4155574B35	13-Sep-99	58	F	None	Yes	Pittsburg Landing	Subyearling	1996	
33	19	88	Right Blue		13-Sep-99	73	F	Adipose	Yes	Pittsburg Landing	Yearling	1996	Open sore on fish and gillnet marks
34	13	56	Left Blue		13-Sep-99	54	M	Adipose	Yes	Captain John Rapids	Yearling	1998	Open sore on fish
35	19	95	Left Green		13-Sep-99	87	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Recovered on Clw at km 32.5 on 12/08
36	13	106	Right Green		13-Sep-99	68	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	Gillnet marks
37	19	36		222E153552	13-Sep-99	76	F	None	Yes	Big Canyon Creek	Subyearling	1996	Open sore on fish AC-222

Appendix 1 (continued)

Seq. No.	Radio Tag Chan	Radio Tag Code	Elastomer Tag	Pit Tag Code	Tag Date	FL (cm)	Sex	Clips	CWT Nose	Initial Release or Tagging Location	Age at Release	Release Year	Notes
38	13	35	Left Blue		14-Sep-99	51	M	Adipose	Yes	Captain John Rapids	Yearling	1998	Open sore on fish, and marine mammal marks
39	13	52	Left Blue		14-Sep-99	59	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
40	19	34		5105374806	14-Sep-99	65	F	None	Yes	Pittsburg Landing	Subyearling	1997	Tag recovered SNR 202.5 on 11/17/99 (male)
41	13	48	Left Blue		14-Sep-99	55	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
42	13	47	Left Blue		14-Sep-99	53	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
43	19	44	Left Green		14-Sep-99	67	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
44	13	4	Right Green		15-Sep-99	74	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
45	19	35	Right Green		15-Sep-99	71	F	Adipose	Yes	Pittsburg Landing	Yearling	1997	
46	13	36	Left Blue		15-Sep-99	51	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
47	13	160	Left Blue		15-Sep-99	57	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
48	19	91	Left Green		15-Sep-99	82	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
49	19	115		41551C3728	16-Sep-99	67	F	None	No	Pittsburg Landing	Subyearling	1996	
50	13	2	Left Green		16-Sep-99	68	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Duplicate tag with Coho tagged October 2
51	13	39	Left Blue		16-Sep-99	51	M	Adipose	Yes	Captain John Rapids	Yearling	1998	
52	19	75	Left Green		16-Sep-99	75	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Gillnet and marine mammal marks
53	19	57	Left Green		16-Sep-99	81	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish
54	19	70		506F56782E	17-Sep-99	61	F	None	No	Pittsburg Landing	Subyearling	1997	Gillnet marks
55	13	46	Left Blue		17-Sep-99	50	M	Adipose	Yes	Captain John Rapids	Yearling	1998	Open sore on fish
56	19	152	Left Green		17-Sep-99	68	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Sores; Tag recovered SNR RM 179.6 on 11/17/99
57	19	97		7F7D36074A	17-Sep-99	102	M	None	No	Snake River RM 202	Natural	1995	Large open sores on fish
58	19	82	Left Green		17-Sep-99	68	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Gillnet marks
59	13	139	Left Green		17-Sep-99	78	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Gillnet marks
60	19	149		5068795E73	17-Sep-99	66	F	None	No	Pittsburg Landing	Subyearling	1997	Gillnet marks
61	19	167	Left Green		18-Sep-99	75	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
62	13	157	Left Green		18-Sep-99	76	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
63	13	142	Left Green		18-Sep-99	66	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
64	19	93	Left Green		18-Sep-99	66	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish
65	19	71	Left Green		18-Sep-99	73	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
66	13	128	Left Green		19-Sep-99	76	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Angler recap 23-Oct
67	13	119	Left Green		20-Sep-99	73	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
68	13	15	Left Green		20-Sep-99	74	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish
69	13	20	Left Green		21-Sep-99	63	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish
70	19	73	Left Green		21-Sep-99	76	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	
71	19	51	Left Green		21-Sep-99	75	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Tag found in trap on 10/10/99
72	13	107	Left Green		22-Sep-99	72	F	Adipose	Yes	Big Canyon Creek	Yearling	1997	Open sore on fish
73	19	103		1F7F186664	23-Sep-99	72	M	None	No	Snake River RM 163	Natural	1995	

Appendix 2

Redd counts recorded from 1959 to 1978 in the Snake River between Lewiston, Idaho, and the Hells Canyon Dam site.

		Year										
River section	**Citation**	**1959**	**1960**	**-**	**1967**	**-**	**1969**	**-**	**1974**	**1975**	**1976**	**-**	**1978**
				-		-		-				-	
Hells Canyon Dam to Pleasant Valley Dam Site	Irving and Bjornn 1980	19	2	-	144	-	294	-				-	
Pleasant Valley Dam Site to Imnaha River		7	2	-	11	-	94	-				-	
Imnaha River to Lewiston, ID		2	0	-	33	-	180	-				-	
		28	**4**	**-**	**188**	**-**	**568**	**-**				-	
				-		-		-				-	
Hells Canyon Dam to Johnon Bar	Witty 1988			-		-	170	-	1	N.D.	8	-	
Johnon Bar to Pleasant Valley				-		-	124	-	10	N.D.	1	-	
Pleasant Valley to Appaloosa				-		-	61	-	3	N.D.	0	-	
Appaloosa to Mountain Sheep				-		-	33	-	2	N.D.	4	-	
Mountain Sheep to State Line				-		-	0	-	0	N.D.	0	-	
				-		-	**388**	-	**16**	**10**	**13**	-	
				-		-		-				-	
Hells Canyon Dam to Asotin, Washington	Groves and Chandler 1996			-		-		-				-	**132**
				-		-		-				-	
				-		-		-				-	
Maximum annual count		**28**	**4**	**-**	**188**	**-**	**568**	**-**	**16**	**10**	**13**	**-**	**132**

Appendix 3. Summary of Expenditures (Funding Period: December 1, 1998 to November 30, 1999).

Category	Projected	Actual	Comments
Personnel			
Permanent	$64,601	$69,290	COLA overlooked in proposal
Overtime Pay for GS-7 Biologists	$760	$396	Less overtime needed than planned
Environment/Hazardous duty pay		$1,011	Hazard pay overlooked in proposal
	$65,361	$70,697	
Travel			
Miscellaneous combined	$7,180	$8,750	
Operations and Maintenance			
Miscellaneous combined	$9,912	$8,497	
Materials and supplies			
Miscellaneous combined	$5,200	$8,367	
Subcontracts			
Wash. Dep. Fish and Wildlife	$7,800	$7,800	
Indirect costs			
Combined	$30,068	$8,045	USFWS reduced overhead for FY 99
Totals			
Combined	$95,453	$104,111	
Amount received at station		$103,498	
Remaining		($613)	Paid for using miscellaneous station funds